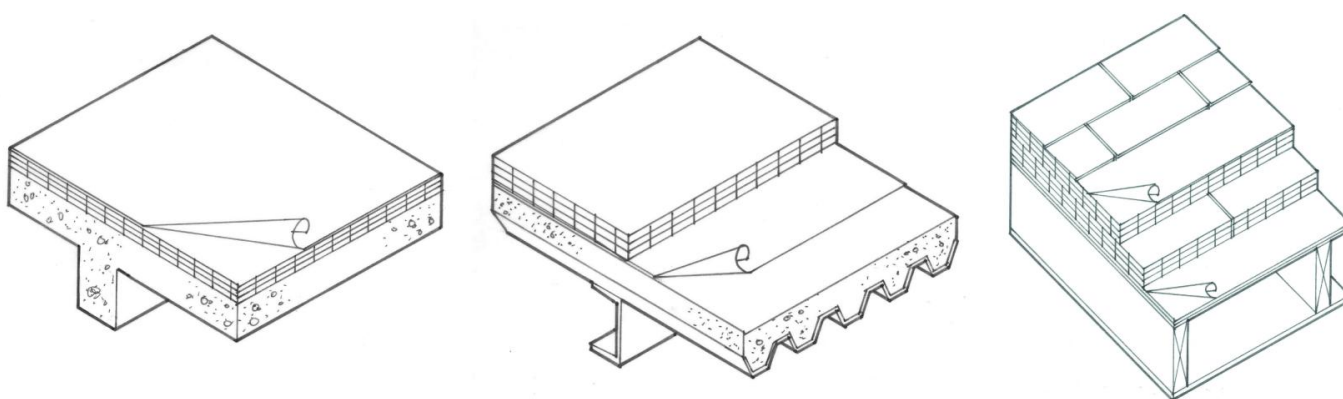


AEDG Implementation Recommendations: Roofs

The Advanced Energy Design Guide (AEDG) seeks to achieve 30 percent savings over Standard 90.1-1999. This guide focuses on improvements to small office buildings, less than 20,000 square feet. The recommendations below are adapted from the implementation section of the guide, and should be used in cooperation with the whole document.* The full design guide is available from the ASHRAE website, [Advanced Energy Design Guide for Small Office Buildings](#).

Insulation Entirely above Deck

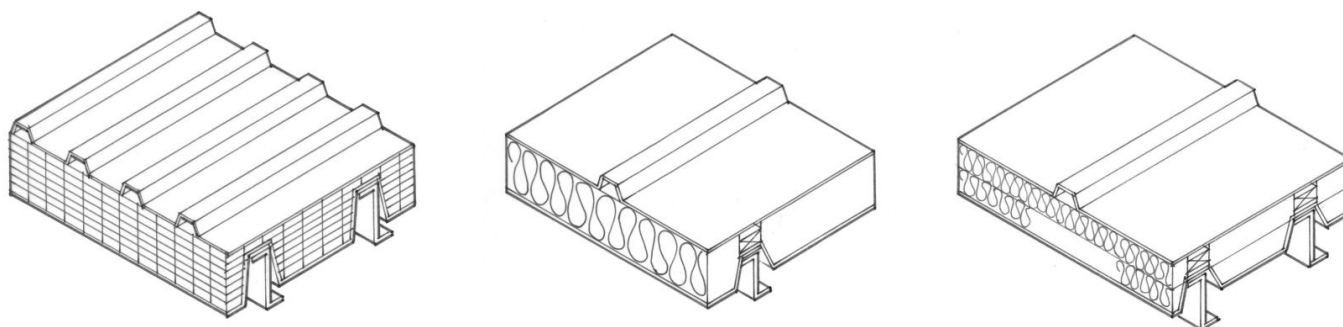


The insulation entirely above deck should be continuous insulation (c.i.) such as rigid boards because there are no framing members present that would introduce thermal bridges or short circuits to bypass the insulation.

When two layers of continuous insulation are used in this construction, the board edges should be staggered to reduce the potential for convection losses or thermal bridging. If an inverted or protected membrane roof system is used, at least one layer of insulation is placed above the membrane while a maximum of one layer is placed beneath the membrane.

Metal Buildings

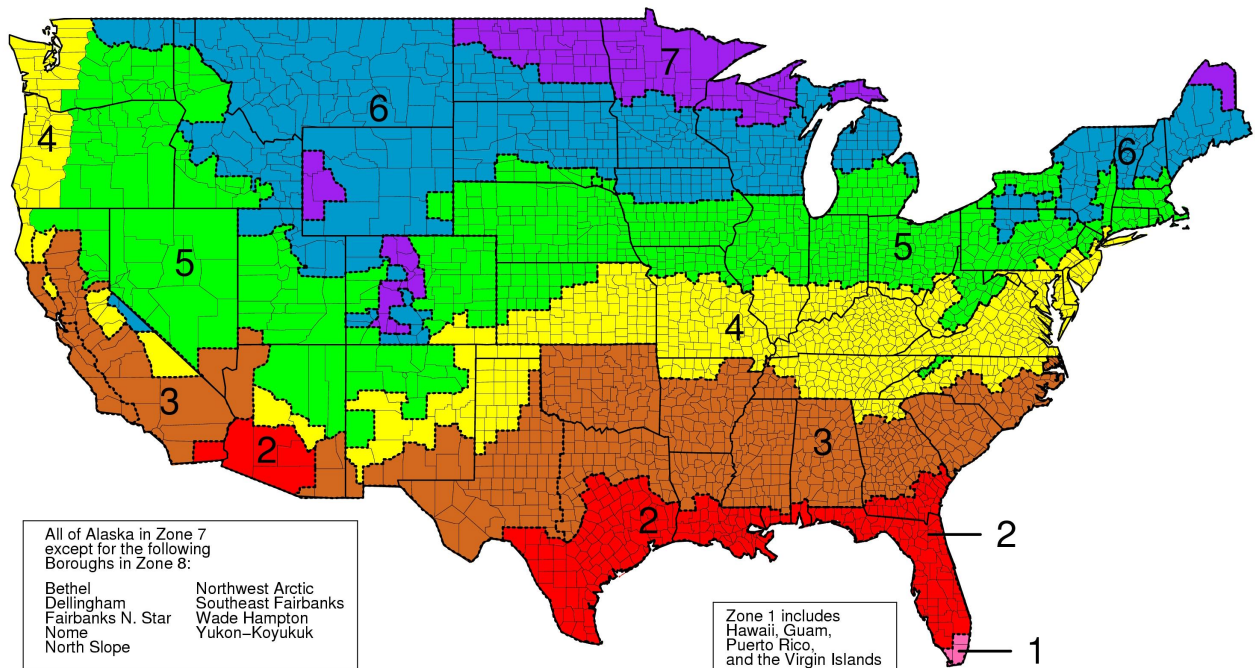
Metal buildings pose particular challenges in the pursuit of designing and constructing advanced buildings. The metal skin and purlin/girt connection, even with compressed fiberglass between them, is highly conductive, which limits the effectiveness of the insulation. A purlin is a horizontal structural member that supports the roof covering. In metal building construction, this is typically a z-shaped coldformed steel member; but a steel bar joist can be used for longer spans.





The thermal performance of metal building roofs with fiberglass batts is improved by treating the thermal bridging associated with fasteners at purlin/girt connections. Use of foam blocks is a proven technique to reduce the thermal bridging. Thermal blocks, with minimum dimensions of 1 inch by 3 inches, should be R-5 rigid insulation installed parallel to the purlins.

Thermal blocks can be used successfully with standing seam roofs that utilize concealed clips of varying heights to accommodate the block. However, a thermal block cannot be used with a through-fastened roof that is screwed directly to the purlins because it diminishes the structural load carrying capacity by "softening" the connection and restraint provided to the purlin by the roof.

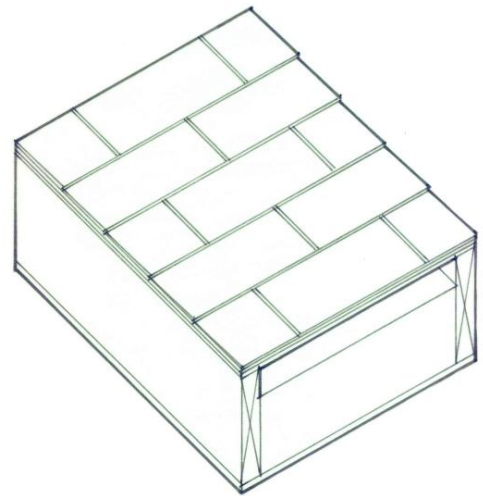
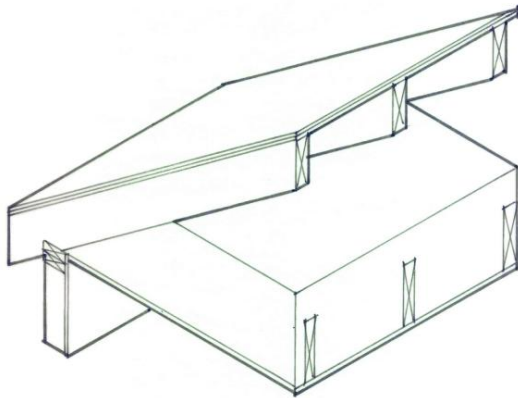


In climate zones 1 and 2, the recommended construction is R-19 insulation batts draped perpendicularly over the purlins. Thermal blocks are then placed above the purlin/batt, and the roof deck is secured to the purlins.

In climate zones 3 through 8, the recommended construction is two layers of batt insulation. The first insulation batt is draped perpendicularly over the purlins with enough looseness to allow the second insulation batt to be laid above it, parallel to the purlins. In the metal building industry, this is known as the "sag and bag" insulation system.

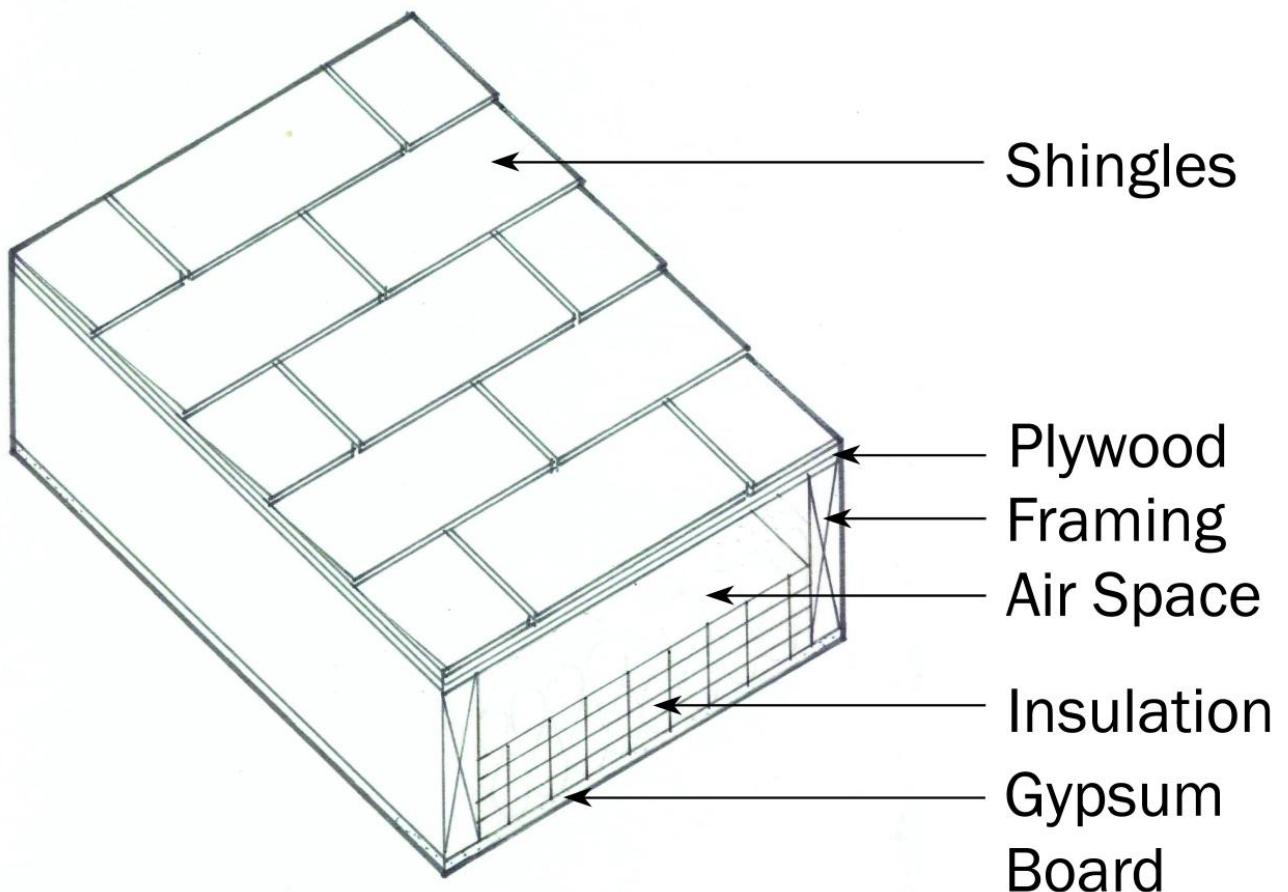
Continuous rigid insulation can be added to provide additional insulation if required to meet the U-factors.

Attics and Other Roofs



Attics and other roofs include roofs with insulation entirely below (inside of) the roof structure (i.e., attics and cathedral ceilings) and roofs with insulation both above and below the roof structure. Ventilated attic spaces need to have the insulation installed at the ceiling line. Unventilated attic spaces may have the insulation installed at the roof line. When suspended ceilings with removable ceiling tiles are used, the insulation performance is best when installed at the roof line.

Single Rafter Roofs





insulation is located in the cavity created between the wood rafters. Single rafters can be constructed using solid wood framing members or truss type framing members. The insulation should be installed between the wood rafters and in intimate contact with the ceiling to avoid the potential thermal short-circuiting associated with open or exposed air spaces.

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